

Discussion Groups Sessions

Very provisionally, here is a list of the questions and themes we would like to address during the interactive sessions of the conference (Brainstorm Sessions 1, 2 and 3; Discussion Groups A, B and C). We anticipate ongoing exchanges amongst participants, including lunch and other breaks. We also see the Brainstorm Sessions as opportunities to gather our thoughts on presentations so far (BR1 on Monday; BR2 on Tuesday; BR3 on Wednesday). We envisage addressing three different questions for discussion in each DG session in three parallel groups, one for each question (A, B) and across the three questions (C). The questions in DGA are rather concrete, those in DGB more abstract and those in DGC are future oriented. Examples of questions for DGA, DGB and DGC follow.

DGA (based on a critical incident as a starter)

A1. What roles (and/or forms) do the notions of derivative (+ differentials) and rate of change play in different disciplines? When do the disciplines introduce concepts/techniques from multi-variable calculus? Are there parallels between the disciplines? Are there epistemological differences? Are there incompatibilities? How (and what) technologies, digital and other, are used in the disciplines?

A2. What role do numerical approaches and approximation play in the various disciplines? Are there parallels between the disciplines? Are there epistemological differences? Are there incompatibilities? How (and what) technologies, digital and other, are used in the disciplines?

A3. What roles (and/or forms) do the notions of integration and differential equations play in different disciplines? Are there parallels between the disciplines? Are there epistemological differences? Are there incompatibilities? How (and what) technologies, digital and other, are used in the disciplines?

DGB

B1. How do students reason about calculus concepts? Is that reasoning compatible with the expectations of the teachers from the disciplines / the teachers who are mathematicians? [Chunkiness as well as discrete data might play a role here.]

B2. How do professionals think with calculus in the various disciplines? What are problems and issues in the disciplines that drive calculus learning (including epistemology); Are these similar across the disciplines? How is calculus used to conceptualize phenomena in the disciplines?

B3. How do professionals of the other disciplines use and reason with technology? What are the problems and issues in the disciplines that require the use of technology and calculus notions? Does technology 'hide' the notions from calculus? How do calculus notions help interpret results provided by technology?

DGC

In three parallel groups, we discuss how to make calculus courses useful and engaging for students in different disciplines, how to go beyond “one size fits all” approaches to calculus course design and how to deliver these courses. Here are some indicative questions:

- What ideas/problems in your discipline necessitate calculus and how could they find their expression in a calculus course?
- What ways of reasoning can be left out of a calculus course as a consequence of disciplinary characteristics?
- How might the standard ordering of a calculus course be changed, e.g. introducing the derived function before looking at the limit of secants or considering the option that integration is introduced before differentiation?
- To what extent (and how) should disciplinary conceptions play a role when teaching calculus?
- How can thinking about calculus concepts from different disciplines enrich each other?
- How can we support instructors in delivering such courses?

Organizational issues: Each discussion session will have a moderator and a reporter. The task of the moderator is to give everybody a chance to contribute, for example by splitting into subgroups and then reporting back to the plenum. The task of the reporter is NOT to write a transcript but to record a list of issues.

Request for reporters

- present the highlights of the discussion
- feel free to use bullet points
- feel free to use images
- keep your report to one page at most
- upload your report on Padlet at [https://padlet.com/ibiza/calconf2023-br-dg-
jyaaw34rkf6e7jtf](https://padlet.com/ibiza/calconf2023-br-dg-
jyaaw34rkf6e7jtf)